ERDC
Engineer Research and Development Center

WARM-MIX ASPHALT FOR AIRFIELD PAVEMENTS

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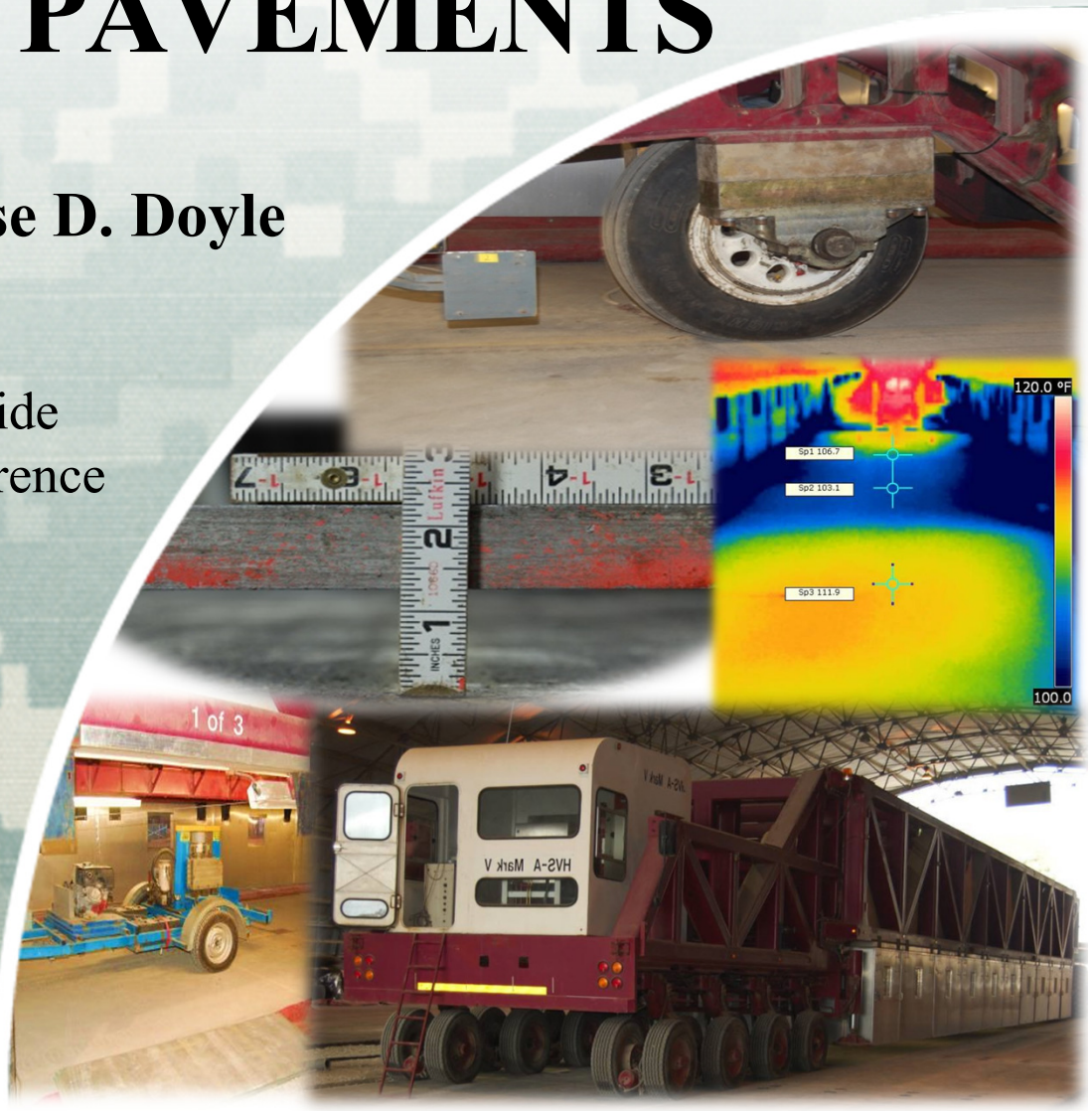


US Army Corps of Engineers
BUILDING STRONG®

Introduction

The asphalt industry seeks emerging technologies that reduce environmental impact during production of asphalt paving materials.

- WMA has replaced HMA for many paving projects.
- WMA performs well on highways.
- WMA airfield paving jobs are limited.

Introduction

Highways	Airfields
Tire Pressures: 110 psi Wheel Loads: 4,000 - 5,000 lb	Tire Pressures: > 300 psi Wheel Loads: 50,000 - 60,000 lb
	

WMA Research at ERDC

- Phase I: Laboratory Evaluation
  - Rutting
  - Binder Properties
  - Moisture Damage
  - Low-Temperature Cracking
  - Durability
  - Workability

- Phase II: Field Evaluation
  - Production and construction procedures
  - Accelerated Pavement Testing (APT)

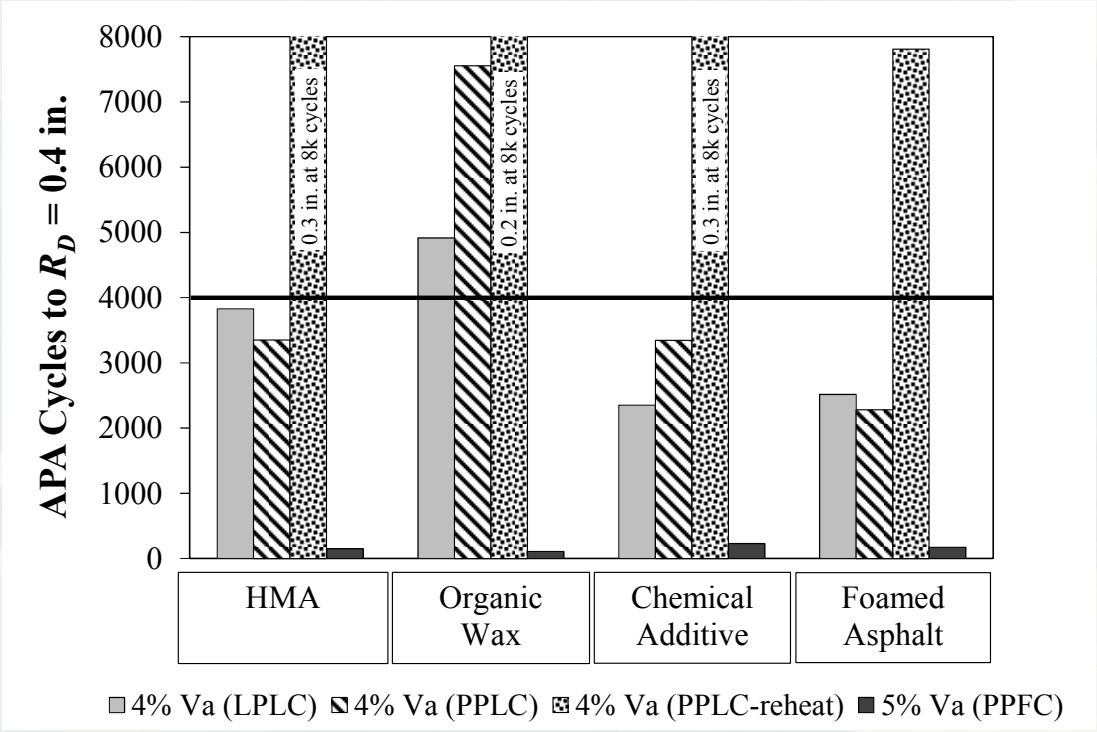
Phase I
Laboratory Evaluation

Experimental Program

- WMA technologies vs. HMA
  - ✓ foaming processes
  - ✓ chemical additives
  - ✓ organic additives
- Sample types
  - ✓ lab mixtures
  - ✓ field mixtures
  - ✓ field cores
- Aggregate types
- RAP
- Temperatures

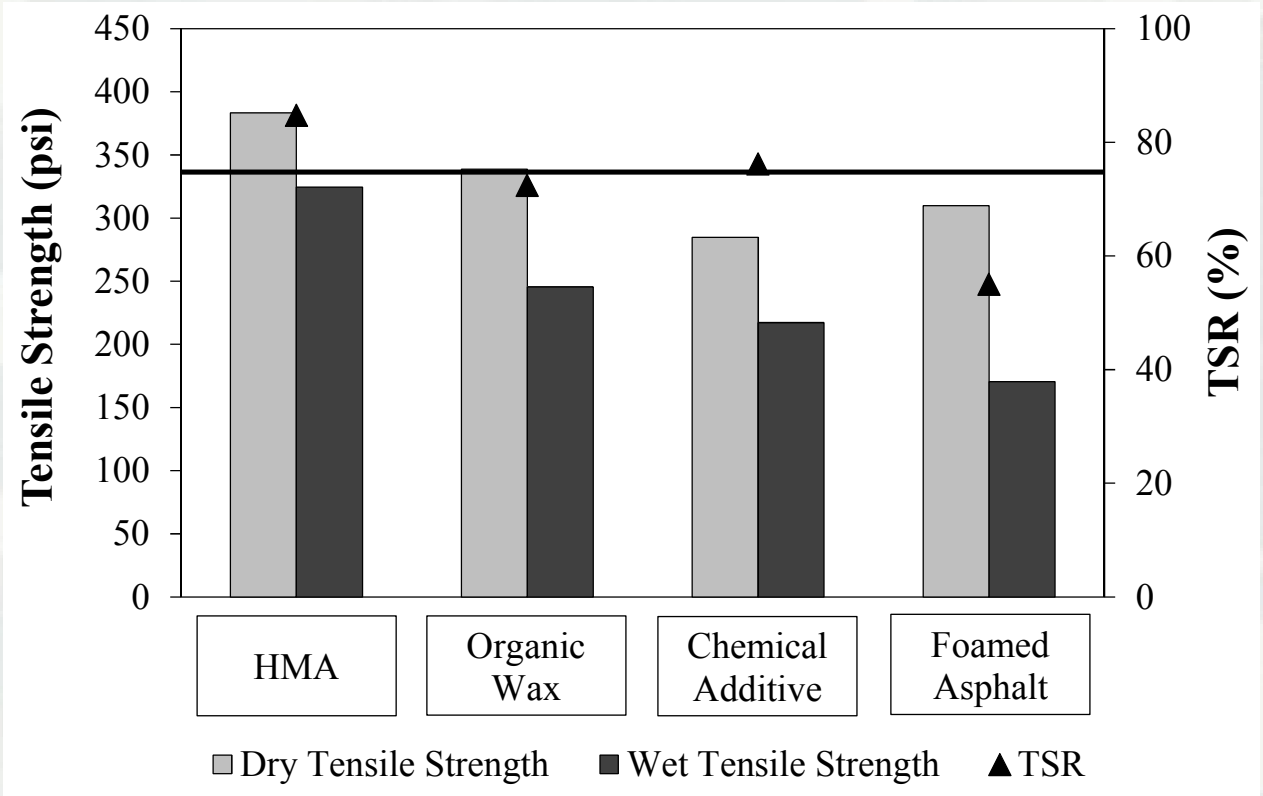
Rutting

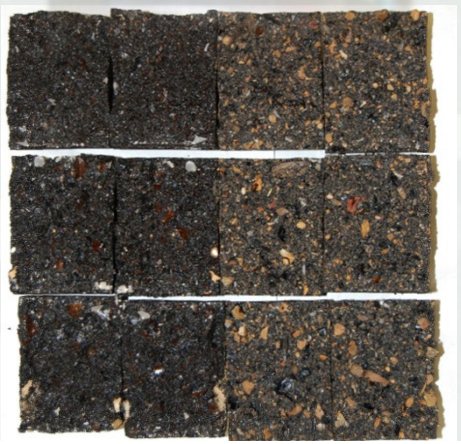
- Asphalt Pavement Analyzer (APA)
- Hamburg Loaded Wheel Tracker
- Static Creep
- Repeated Load
- Dynamic Modulus



Moisture Damage

- AASHTO T 283 Tensile Strength Ratio (TSR)
- Hamburg Test

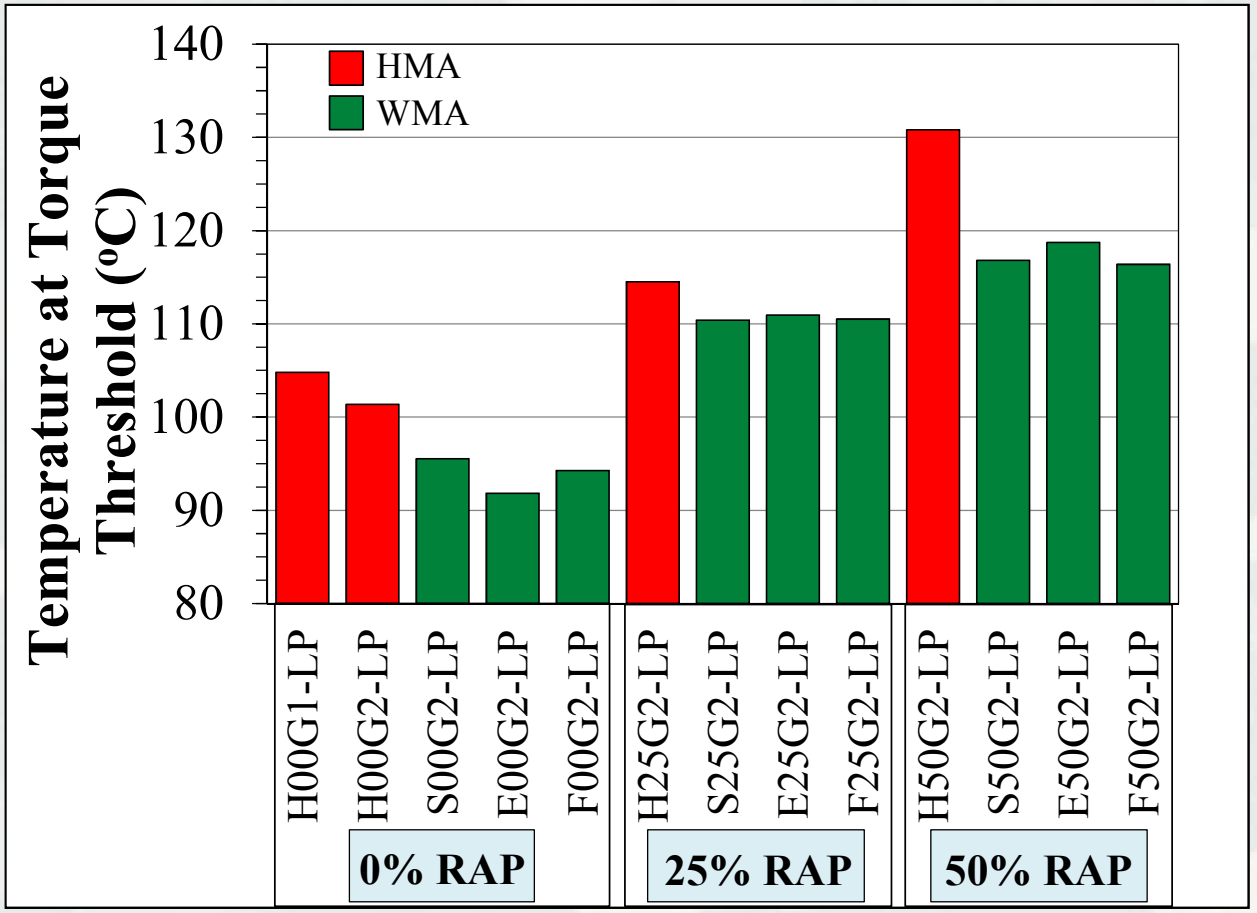




Unconditioned Conditioned

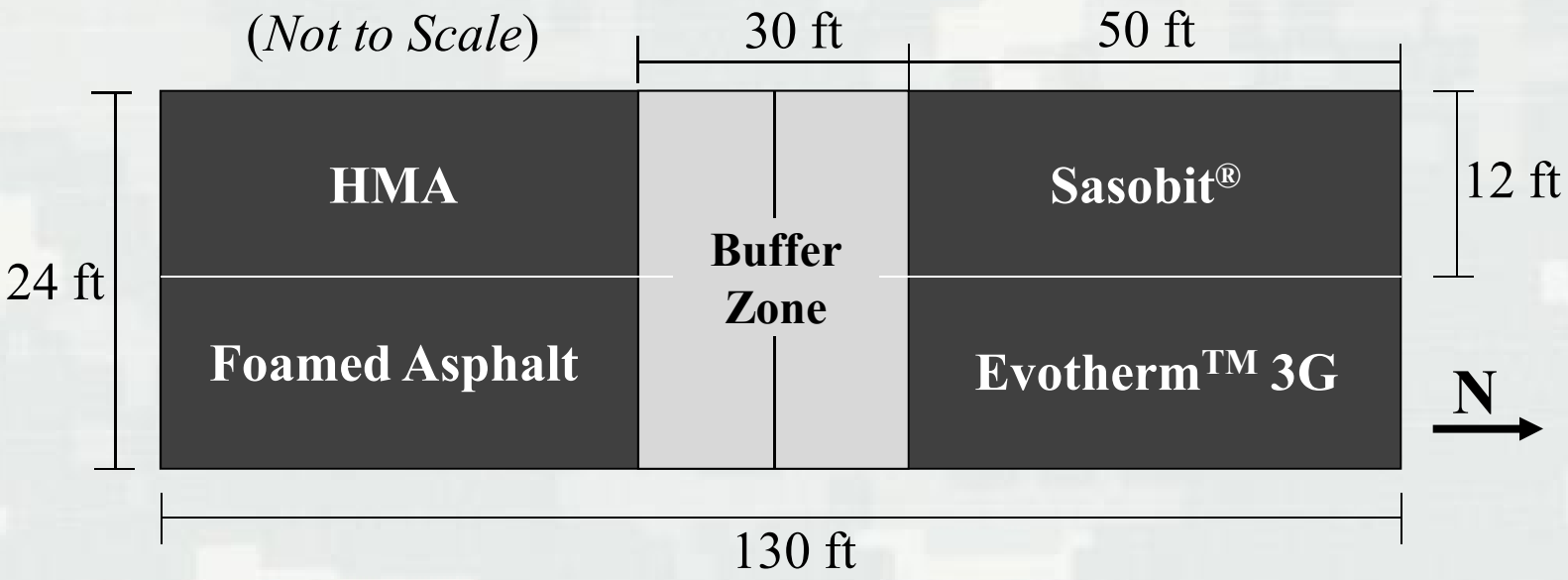
Workability

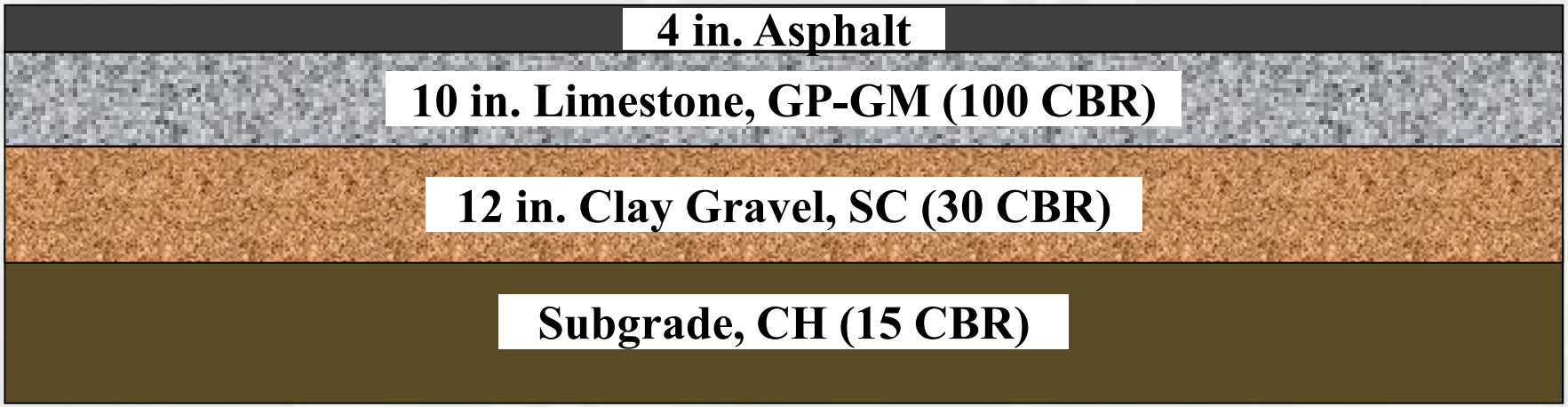
Torque method



Phase II
Field Evaluation

Test Section Design

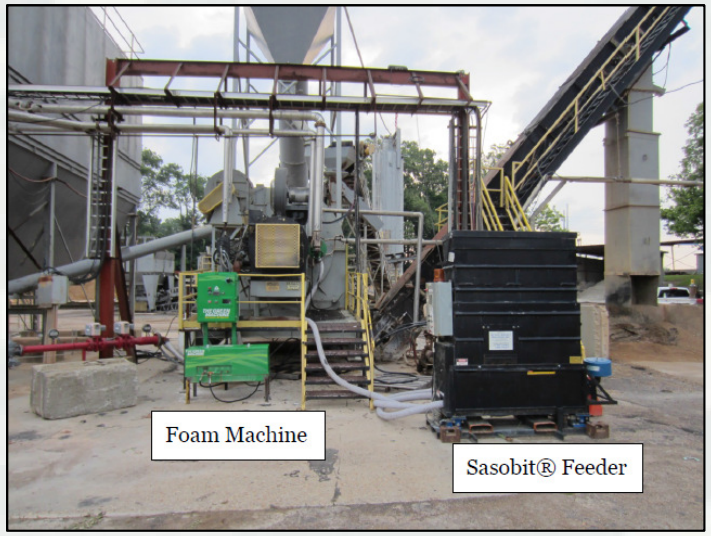


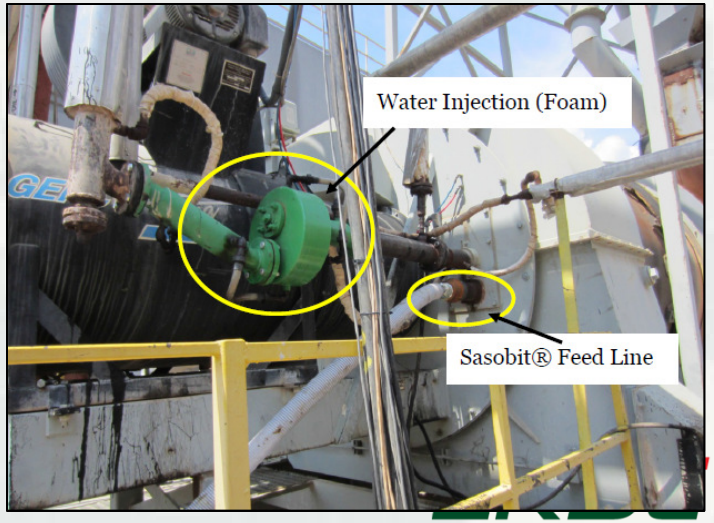


Test Section Construction

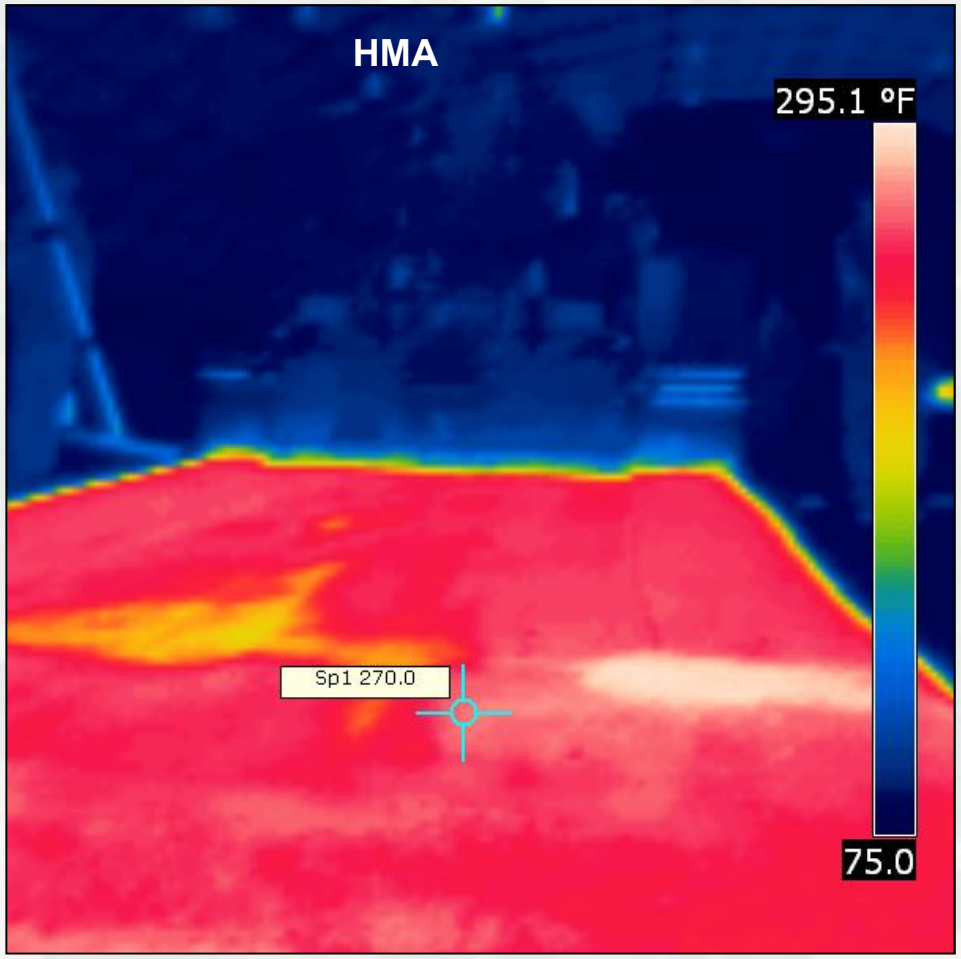
Asphalt Production

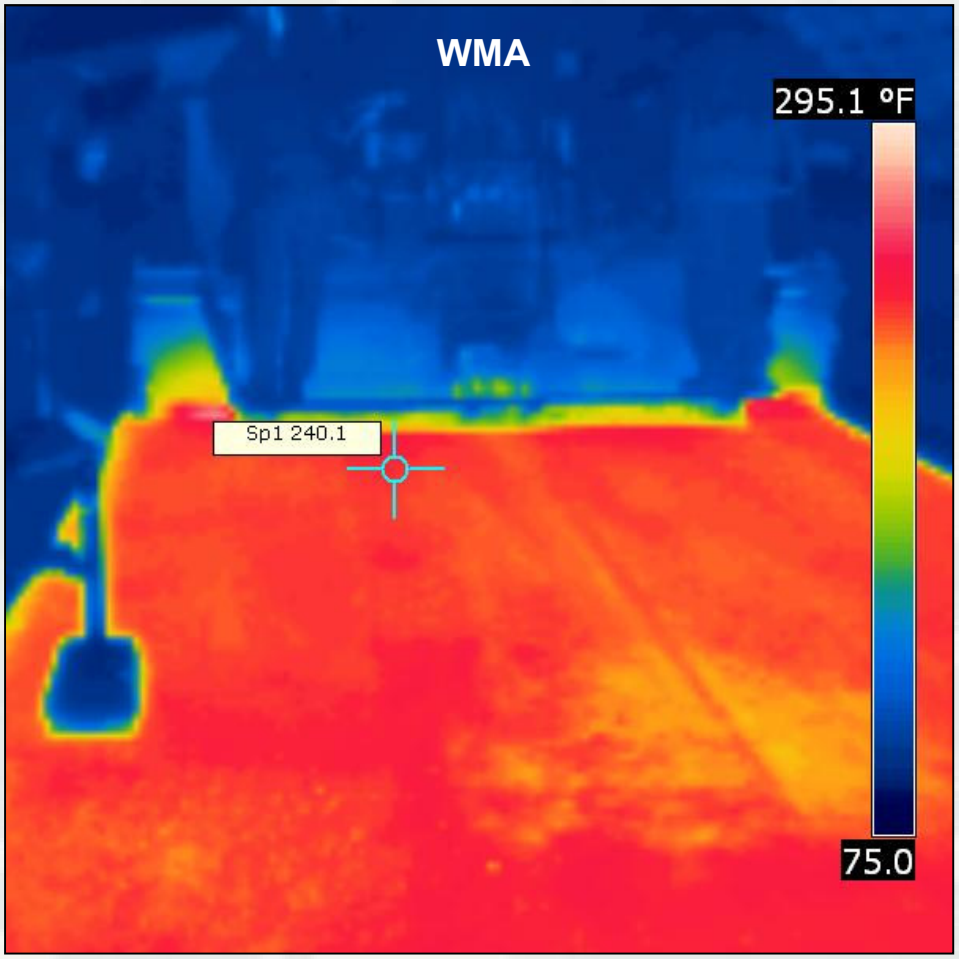
- Average temperatures:
  - HMA - 290°F
  - WMA - 270°F





Asphalt Paving

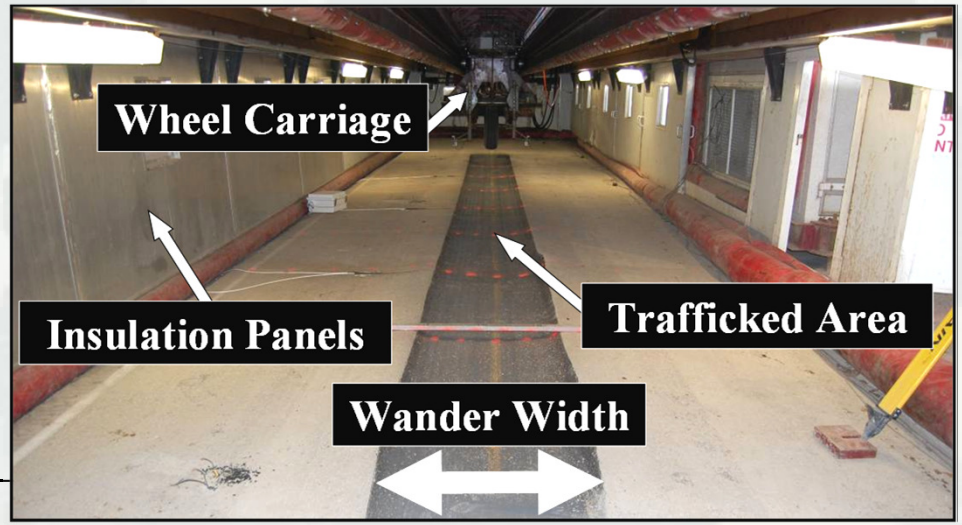

HMA
295.1 °F
Sp1 270.0
75.0


WMA
295.1 °F
Sp1 240.1
75.0

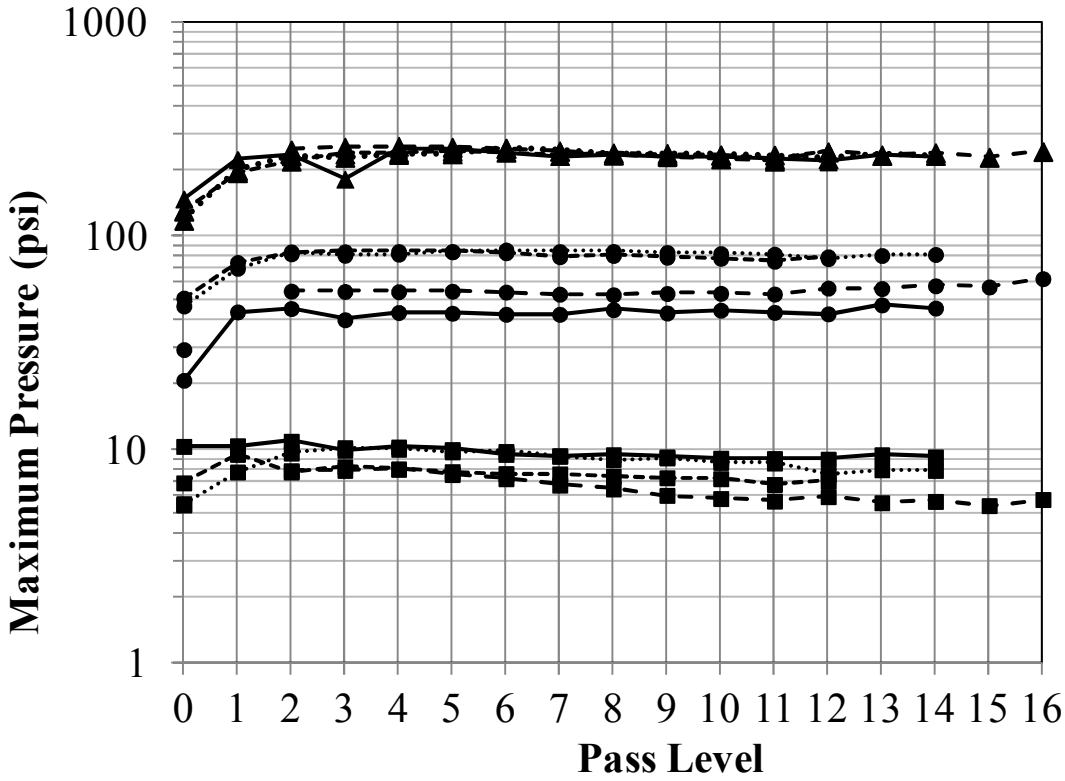
Simulated Traffic Conditions

- F-15E traffic loading
  - 35.5-kip wheel load
  - 325-psi tire pressure
- normally distributed traffic wander pattern

- Pavement temperature:
  109 °F
- Failure:
  1 in. permanent deformation



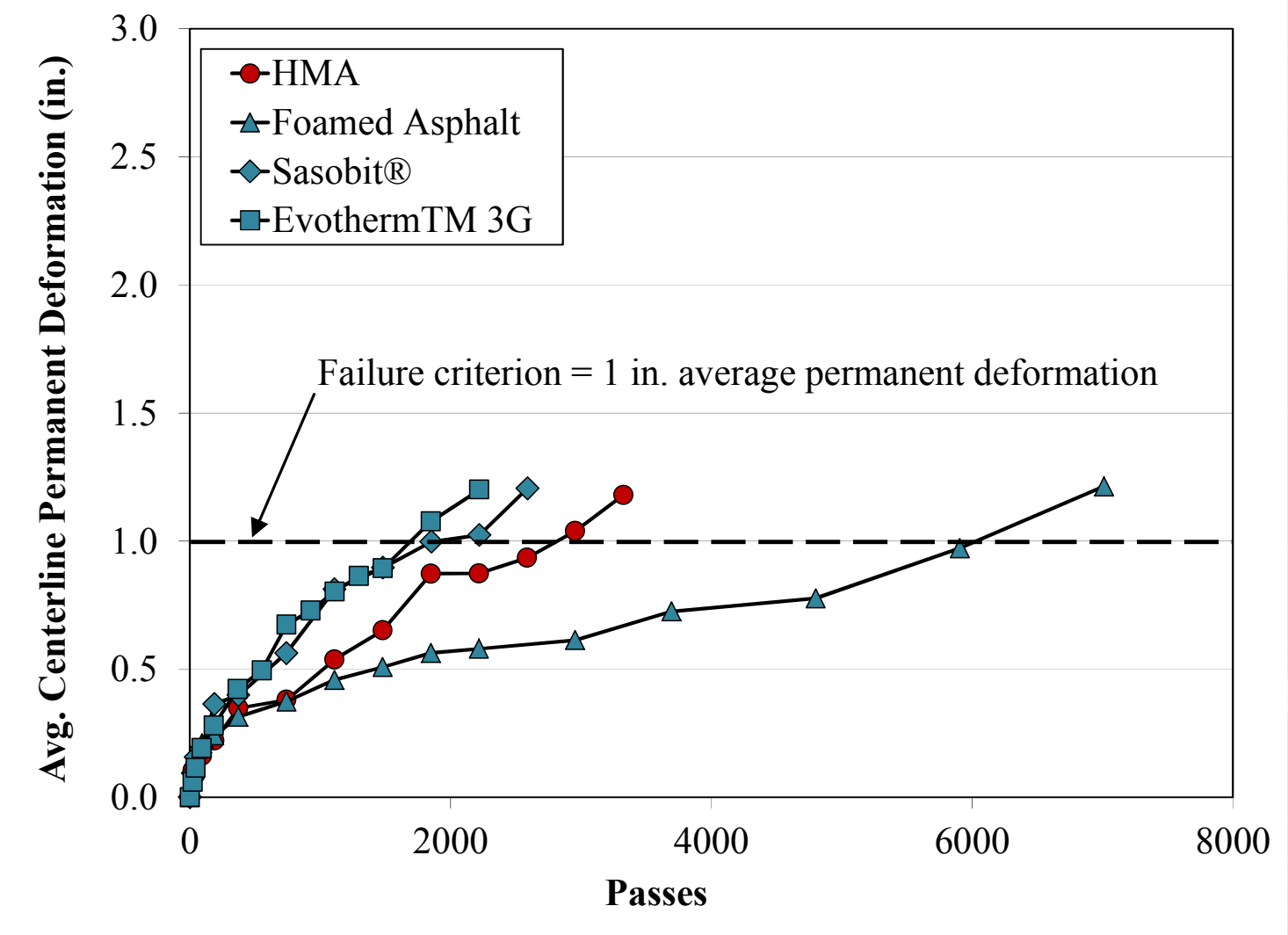
APT Results



Pass Level	No. of Passes			
	H: HMA	F: Foamed Asphalt	S: Sasobit®	E: Evotherm 3G
0	Pre-Heat	Pre-Heat	Pre-Heat	Pre-Heat
1	0	0	0	0
2	23	23	23	23
3	46	46	46	46
4	94	94	94	92
5	188	188	188	184
6	372	372	372	368
7	742	742	740	552
8	1110	1110	1110	741
9	1480	1480	1482	927
10	1850	1850	1852	1111
11	2218	2218	2220	1297
12	2588	2956	2590	1481
13	2956	3694	---	1849
14	3326	4800	---	2221
15	---	5906	---	---
16	---	7012	---	---

APT Results

APT Results


HMA
Foamed Asphalt
Sasobit®
EvothermTM 3G
Failure criterion = 1 in. average permanent deformation
Avg. Centerline Permanent Deformation (in.)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2000
4000
6000
8000
Passes

Conclusions and Recommendations

- The laboratory evaluation results showed that WMA could perform similar to comparative HMA.
- WMA can be produced, placed, and compacted at temperatures 20-30°F lower than an HMA.
- Field rutting performance results showed that on average WMA mixtures had rutting resistance similar to that of the HMA mixture.
- WMA is a viable alternative to HMA for wearing surfaces on airfields.

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Technology Transfer

- **ETL 11-3** (2011): general information on WMA technologies
- **UFGS 32 12 15.16** (2012): specific guidance on construction of airfield pavements using WMA.
- **ETL** (under review): highlights the most important aspects of the specifications.

- These documents are available in the **Construction Criteria Base of the Whole Building Design Guide**: **http://www.wbdg.org/ccb/ccb.php**

Questions